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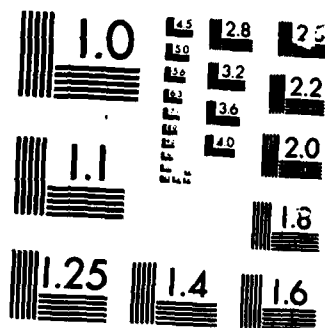   PERSONNEL RESEARCH AND DEVELOPMENT CENTER SAN DIEGO CA
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San Diego, California 92152

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March 1986

DEVELOPMENT OF A NAVY OFFICER END-OF-ACTIVE-OBLIGATED-SERVICE (EAOS) DATE

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The Navy has been unable to identify officers who are free of all obligated service and eligible to leave. This report describes development and evaluation of an algorithm to predict an end-of-active-obligated service (EAOS) date for officers. Case studies illustrating how the algorithm computes EAOS dates are presented. Two applications using the EAOS date are described.

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FOREWORD

This report describes development and evaluation of an algorithm to predict an end-of-active-obligated-service (EAOS) date for officers. Use of the EAOS date is expected to improve forecasting of officer losses. The effort was conducted under subproject Z1170-MP008 (Computer-based Manpower Planning and Programming), sponsored by the Deputy Chief of Naval Operations (Manpower, Personnel, and Training) (OP-01). The objective of the subproject is to develop a set of user-oriented, computer-based models and data bases to assist in the development of an officer force that meets the Navy's requirements for manpower. Appreciation is expressed to CDR D. Liuzzi (NMPC-41, formerly of OP-136D) for assistance in obtaining information on officer obligation programs.

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SUMMARY

Problem

Navy officer personnel promotion and accession plans depend on accurate estimates of expected losses. A good loss forecast begins with the separation of officer personnel into those eligible to leave the Navy and those still under a service obligation. Unfortunately, the Navy has been unable to make a clear distinction between these two groups. The only measure of obligation available on a Navy officer's computerized personnel record, the minimum service requirement (MSR) date, accounts only for the obligation incurred by source of entry and primary warfare training. Obligations incurred after the expiration of the MSR do not appear on the personnel record. A more comprehensive measure is needed to capture all obligations.

Objective

The objective of this effort was to develop, test, and validate an algorithm that calculates an end-of-active-obligated-service (EAOS) date for Navy officers. The EAOS date is an approximation of when an officer is eligible to leave the Navy.

Approach

A two-stage algorithm was developed to calculate an EAOS date. The initial stage extracts any data elements from officer master file records that may indicate that an obligation has been incurred. The EAOS date is computed in the second stage. The algorithm accounts for changing obligations and types across time, as well as newly implemented obligation programs. The methodology is generalized enough to compute an EAOS date for members of any officer community; only slight modifications of the current logic would be necessary to adapt the software to a particular community.

Case Studies

Two case studies were developed to illustrate the calculation of the EAOS date. Each included a variety of programs that led to additional obligated service. Step by step, the case studies present events and the interim dates or obligations that are calculated and stored by the algorithm. The case studies clearly demonstrate the inappropriateness of the MSR date as a measure of eligibility.

Validation

EAOS dates were calculated for pilots who left the Navy during FY78 and FY83, and each date of loss was compared to the calculated EAOS date. An officer who left during the EAOS date window (EAOS date minus 1 year) or after the EAOS date was considered to have been eligible to leave the Navy. Less than 1 percent of the 1978 voluntary losses and about 3 percent of 1983 losses occurred before the EAOS date window.

Conclusions

(1) It is possible to calculate an EAOS date for officers, and the performance of the EAOS date in several validation tests suggests that the algorithm is calculating the EAOS date with reasonable accuracy.

(2) The EAOS date has been used to establish the time remaining on contract, and, in turn, determine eligibility to leave the Navy. The usefulness of the EAOS date should extend much farther. Research is ongoing to determine the contribution to officer loss forecasting methods.

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INTRODUCTION

Problem

Navy officer personnel promotion and accession plans depend on accurate estimates of expected losses. A good loss forecast begins with the separation of officer personnel into those eligible to leave the Navy and those still under a service obligation. As might be expected, the majority of losses come from the former group. Unfortunately, the Navy has been unable to make a clear distinction between the officers eligible and ineligible to leave.

At present, the minimum service requirement (MSR) date is the only measure of service obligation available on an officer's computerized personnel record. However, the MSR includes only obligation incurred by source of entry (e.g., Naval Academy) and primary warfare training (e.g., basic flight training). Obligations incurred after the expiration of the MSR do not appear on the personnel record. Because use of the MSR alone can lead to an inaccurate measurement of eligibility (Bres & Rowe, 1983), a more comprehensive measure is needed to capture all obligations.

Objective

The objective of this effort was to develop test, and validate an algorithm that calculates an end-of-active-obligated-service (EAOS) date for Navy officers. The EAOS date is an approximation of when an officer is eligible to leave the Navy.

Background

A number of programs (see Table 1) require officers to incur obligations for additional service in exchange for Navy-sponsored education and training, lateral transfer and augmentation, and continuation bonuses. These programs differ in the length of their obligation and the rules governing the ways the obligation can be served, and many have changed over time. Consecutive obligations require that the additional service be performed after all other obligated service is completed. In contrast, a concurrent obligation may be discharged simultaneously with existing obligations. To add to the complexity, some programs that initially required a concurrent obligation have since shifted to requiring a consecutive obligation, and the reverse. All these accumulated obligations must be captured explicitly to calculate an officer's EAOS date.

Three questions must be answered to compute an estimated EAOS date:

1. Are the data required readily available?

2. Are the programs that result in additional obligation firmly established and documented?

3. Can the calculated EAOS date be validated?

The methodology used to calculate the EAOS date must be able to operate under four different scenarios:

1. The officer is still serving the MSR and has incurred no additional obligation. For this person, the EAOS date is the same as MSR.

Table 1

Sources of Obligation for Additional Navy Service

Education

- Burke program
- College degree program
- Law education program
- Navy sponsored graduate education
- CNO scholar and scholarship program

Service Schools

- Defense Intelligence School
- Service colleges (War College, Postgraduate School, etc.)
- Surface Warfare Department Head School
- Nuclear Propulsion Plant Operator School
- Test Pilot School

Augmentation

Lateral transfer

Duty at the Naval Academy

Promotion   (To Grades O-4, O-5, and O-6)

Aviation officer continuation pay (AOCP)

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2. The officer is still serving the MSR but has incurred some additional obligation (e.g., the officer participated in a Navy-sponsored graduate education program). The EAOS date will be the MSR date plus the additional obligation.[1]

3. Following an officer's MSR date, he or she incurs an additional obligation. The EAOS date is the time the additional obligation ends.

4. The officer's MSR date has expired and no additional obligation has been incurred. The EAOS date is the MSR date.

All personnel-specific information used to calculate an EAOS date was taken from the officer master file (OMF), for the beginning of each fiscal year, FY74-85. Information on the obligations particular to each program was obtained from the Compendium of Obligation Programs for Officers (Naval Military Personnel Command, 1983).

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[1]The EAOS date will depend on whether the additional obligation was consecutive or concurrent. In a special version of the concurrent case, the additional obligation is exhausted prior to completion of the MSR. Then the EAOS date is simply the MSR.

The Navy's aviation community was chosen as a test case for this research because of the large number and variety of obligation programs that impact it. However, the methodology is generalized enough to compute an EAOS date for members of any officer community, with slight modifications of the current logic to adapt the software. Programs that apply to only one community (e.g., bonus programs) would not be used in the computation of an EAOS date for members of other communities.

APPROACH

EAOS Date Computation Methodology

The calculation of an EAOS date is a two-stage process. Stage 1 extracts from an OMF record any data elements containing information that may indicate that an obligation has been incurred. Based on the data values and the obligation programs, interim EAOS dates are calculated for each of the major headings in Table 1. As illustrated in Figure 1, the algorithm used to calculate an EAOS date begins the computation with the education fields. Because education programs have changed their type and length of obligation over time, it is necessary to identify the year and month in which each person entered a particular program. These dates are not available from individual records and must be inferred by subtracting the duration of a program from the date each person completed it. With this date, the algorithm determines the obligation length and type that were in effect when the person entered the program, and then adds the calculated obligation to the completion date to arrive at an interim education EAOS date. This procedure is performed for each of the two education fields on the OMF. The interim values are set to 0000 if a program led to no obligation or if the data elements were empty.

Each OMF record contains five service school fields. The software first checks the information located in the fifth field. If the school indicated required an obligation, the logic calculates an interim EAOS date to represent the date the obligation expires. If no data are entered in the field, or if the school does not lead to an obligation, then the interim EAOS date is set to 0000, and the program proceeds to the fourth field, and so on until all service school fields have been examined. At the conclusion of this procedure, the program has stored five interim EAOS date values, one for each field.

Officers who choose to convert from a reserve to a regular commission status, an event called "augmentation," or who transfer laterally to a new community, incur a 2-year concurrent obligation. The program compares an officer's current designator with the most recent previous one. If the logic detects a change in designator denoting augmentation, 2 years are added to the date the designator changed to arrive at the interim augmentation EAOS date. The interim lateral transfer EAOS date is calculated in the same manner. If the previous designator differs from the current designator indicating a community change, the 2-year obligation is added to the date the designator changed to establish the interim lateral transfer EAOS date. The dates are set to 0000 if no designator change occurred.[2]

The remaining three programs are recent additions to those that lead to additional obligated service, the oldest having been implemented in 1981. An officer who was assigned to a nonstudent billet at the Naval Academy after 1 October 1981, and who has

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[2] Changes from a training designator to an operational designator (e.g., 139X to 131X) are not considered lateral transfers, and therefore, no obligation is incurred.
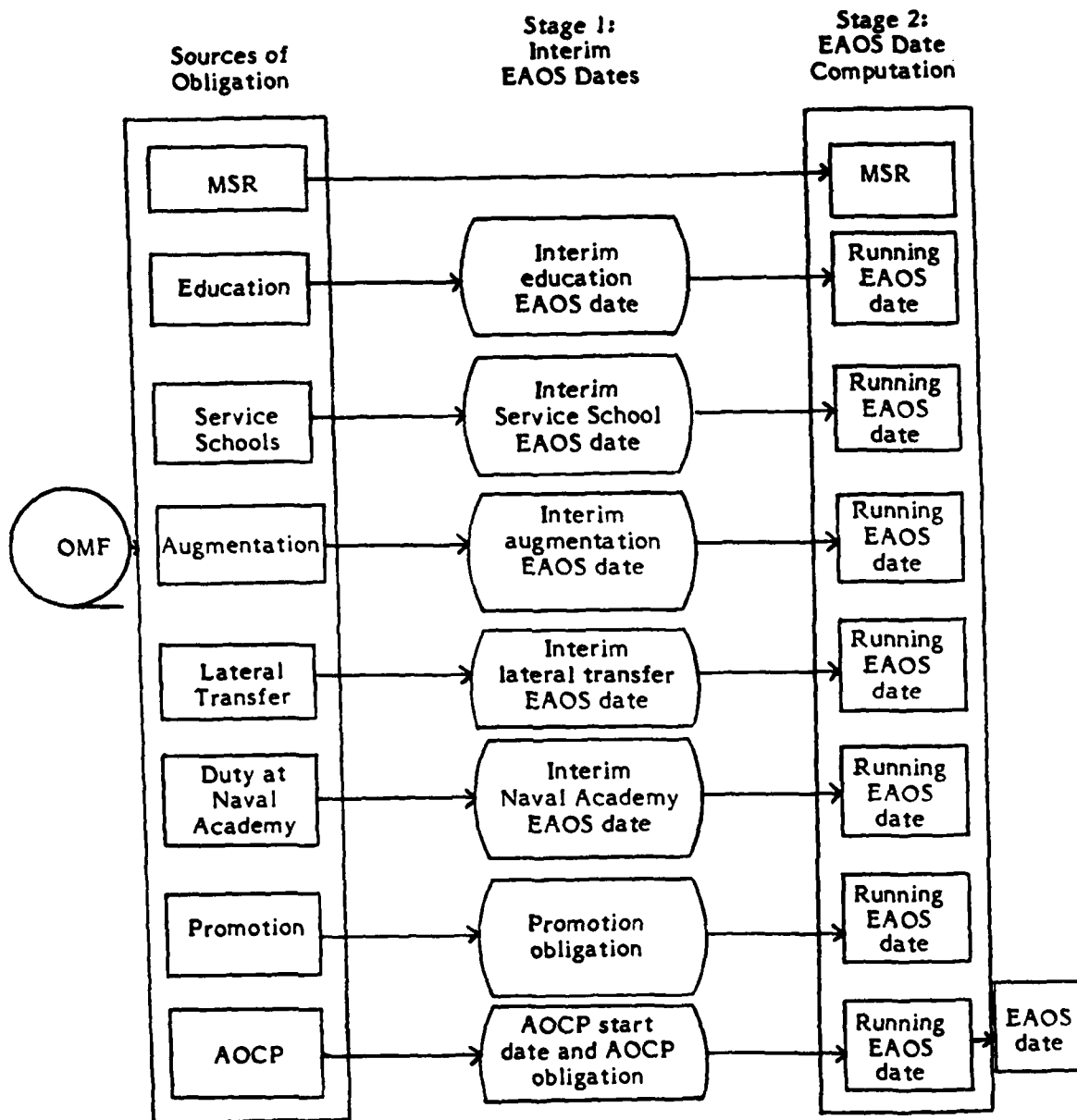
Figure 1. EAOS date algorithm

served in the billet for more than 1 year, incurs a 2-year obligation. The algorithm examines the OMF fields for the five most recent duty stations and then calculates an interim EAOS date for each field. The obligation is concurrent and is added to the date the officer left the billet. Because the Naval Academy program is new, no one had met all of the criteria for obligation under it at the time of this research. As officers meet the criteria, the software will accommodate their changed status.

Since FY83, officers promoted to lieutenant commander (O-4), commander (O-5), or captain (O-6), and who are also eligible to retire, have incurred additional obligated service. Newly promoted O-4s receive a 2-year obligation, while O-5s and O-6s get 3 years. The obligation is served concurrently with all other obligations. Therefore, the program stores only the obligation amount and does not calculate an interim EAOS date.

The aviation officer continuation pay (AOCP) program, initiated in July 1981, is the final source of obligation included in the EAOS date algorithm. AOCP participants sign a contract to remain on active duty for a specified number of years in exchange for a bonus. This obligation runs concurrently with other obligations. The program checks the OMF record for the date each officer began receiving the pay as well as the length of the contract.

Finally, because an MSR (the date when an officer's initial obligation expires) is required before the computation of the EAOS date can begin, the program calculates an MSR for those who do not have one on the OMF. The MSR for pilots who are still in training is calculated by adding the obligation incurred from source of entry (e.g., Naval Academy) to the active commission base date (ACBD). For pilots who have completed training (e.g., current designator is 131X and most recent previous designator is 139X) and who do not have an MSR, 5 years are added to the date the designator changed to arrive at the calculated MSR.

At this point the software has stored all of the information needed to calculate an EAOS date (see Figure 1, column 2): an MSR date, five interim service school EAOS dates, two interim education EAOS dates, an interim lateral transfer EAOS date and an interim augmentation EAOS date, three interim Naval Academy EAOS dates, the obligation for being promoted, and the AOCP start date and AOCP obligation. The software now begins Stage 2, the calculation of the final EAOS date, by checking the interim EAOS dates and obligations, both type and length. As it checks dates and obligations, the program computes a "running," or cumulative, EAOS date (see Figure 1). Upon completion of the program, the running EAOS date becomes the final EAOS date.

In Stage 2, the computation begins again with the education programs. If the interim EAOS date calculated in Stage 1 is not 0000, the software checks whether the obligation is concurrent or consecutive. If it is concurrent, the logic checks whether the obligation will be discharged before the MSR expires, in which case the running EAOS date is the MSR. Should some obligation remain, the running EAOS date is set to the date the obligation expires. If the obligation is consecutive, the obligation amount is added to the MSR to arrive at the running EAOS date. Beyond this point, the MSR is no longer used; any additional obligations are added to the running EAOS date.

CASE STUDIES

The following case studies illustrate the way the software calculates an EAOS date. A variety of programs and combinations of programs are considered. To simplify
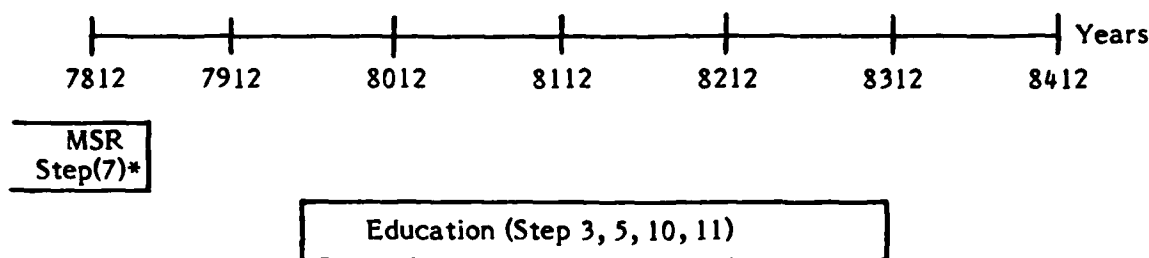
calculations, all dates and obligations use the YYMM format: For example, December 1983 is 8312, and an obligation of 3 years and 6 months is 306.

Case Study 1

LCDR A. Earhart (see Table 2 and Figure 2) entered the Navy as a regular commissioned officer in 1974, and at the conclusion of flight training, her MSR was calculated to expire in March 1979. The majority of LCDR Earhart's career has been spent in operational billets, primarily in squadrons. She did, however, spend 18 months in a Navy-sponsored education program that ended in 1980. She is not participating in the AOCP program, and she has attended no other programs that incurred additional obligation.

Table 2

Software Logic for Case Study 1

Step	Event	Date or Obligation
1.	Logic assigns the month June to the year the education program was completed.	8006
2.	Duration of 18 months is converted to years and months.	106
3.	Beginning date of program is calculated by subtracting duration from year completed.	7900
4.	Obligation amount in effect when Earhart began the program requires 3 months obligation for each month in the first year of the program, and month-for-month obligation for each additional month. Obligation amount is calculated as 42 months, converted to years and months.	306
5.	Interim education EAOS date is calculated by adding the obligation to the date LCDR Earhart completed the program. (8006 + 306)	8312
6.	Logic detects no other programs that lead to additional obligation.	
7.	Algorithm checks for MSR and finds a valid date.	7903
8.	Logic checks the date program began and determines that the obligation is consecutive.	
9.	Comparison is made between year the program was completed and the MSR.	
10.	Because the program was completed after the MSR had expired, the running EAOS date is the interim education EAOS date calculated in Step (5).	8312
11.	With no further obligations, LCDR Earhart's EAOS date is December 1983.	8312

```
|----+----+----+----+----+----+----| Years
7812  7912  8012  8112  8212  8312  8412
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┌─────────────┐
│ MSR   │
│ Step(7)*   │
└─────────────┘

┌──────────────────────────────────────┐
│   Education (Step 3, 5, 10, 11)   │
└──────────────────────────────────────┘

*Step refers to steps listed in Table 2.

Figure 2. Time line depicting software logic for case Study 1.

Case Study 2

LT C. Lindbergh (see Table 3 and Figure 3) entered the Navy as a regular officer. Upon completion of flight training, his initial aviation service obligation was calculated to expire in March 1980. Before completing his MSR, LT Lindbergh attended the Navy's Test Pilot School at Patuxent River, Maryland. He completed the course, which lasted 48 weeks, in June 1979. LT Lindbergh accepted an AOCP bonus when it was first offered, and he began his AOCP obligation in October 1981. Having more than 6 but less than 9 years of aviation service, LT Lindbergh had the option of choosing an AOCP contract of 1, 2, 3, or 4 years. LT Lindbergh elected a 3-year contract.

VALIDATION

Because the EAOS date for officers has not been maintained in the past, and thus is not available for comparison with the experimentally produced date, an alternative validation method had to be devised. Records of officers leaving the Navy during FY78 and FY83 were extracted from the officer loss file. The EAOS date software was applied to each record, and an EAOS date calculated. An officer's loss date was then compared to his or her EAOS date. If the logic is calculating the EAOS date correctly, the number of officers leaving before their EAOS date should be small, and the majority of those separations should be involuntary.[3]

During FY83, the aviation communities (designators 130X, 131X, 139X) experienced 764 losses, 150 of which occurred before the calculated EAOS date.[4] The majority of these losses (142) were for involuntary reasons, mostly RADs. The remaining 8 officers (1% of total losses) left for voluntary reasons.

Of the FY83 losses from the aviation community, 600 (78.5%) occurred after the calculated EAOS date. Because the calculated EAOS date had expired, it was anticipated that the majority of the losses would be voluntary and, in fact, more than 71 percent are classified as voluntary losses. Only 1 percent of the losses occurring before the expiration of the EAOS date were voluntary.

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[3] Involuntary losses include death, discharge, and release from active duty (RAD).
[4] Fourteen officers have no EAOS date because the MSR field was blank or contained invalid data.

Table 3

Software Logic for Case Study 2

Step	Event	Date or Obligation
1.	Obligation for attending test pilot school is 4 years. The algorithm calculates the interim service school EAOS date by adding the obligation (400) to the year the individual completed the program (7906).	8306
2.	Algorithm checks for MSR and finds a valid date.	8003
3.	Logic compares the date LT Lindbergh completed the test pilot course with the running EAOS date. (Since Lindbergh incurred no obligation from other education programs, the running date remains the MSR.) The logic determines that the date he completed the course (7906) is prior to the running EAOS date (8003).	
4.	The obligation incurred from attending test pilot school is consecutive. The algorithm calculates a new running EAOS date by adding the obligation from test pilot school (400) to the running EAOS date (8003).	8403
5.	The algorithm checks whether the AOCP start date (8110) is after the running EAOS date (8403). Since it is not, an AOCP end date is calculated by adding the obligation (300) to the AOCP start date (8110).	8410
6.	The algorithm compares the AOCP end date (8410) with the running EAOS date (8403) and sets the new running EAOS date to the higher of the two.	8410
7.	Because no other obligations were incurred, LT Lindbergh's EAOS date is October 1984.	8410
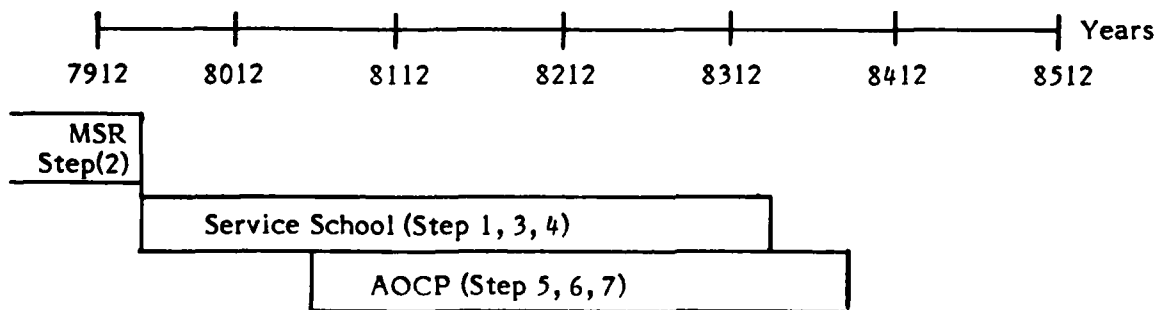
*Step refers to steps listed in Table 3.

Figure 3. Time line depicting software logic for Case Study 2.

Because a number of its components must be estimated or inferred, the EAOS date calculated by this program is intended as an approximation. It is appropriate, therefore, to establish a "window" of time--1 year before the EAOS date--to allow for assumptions that had to be made. An officer who leaves the Navy within the window is counted with those who left after the expiration of their EAOS date.

Of the 29 voluntary losses, 8 occurred within the window of a year before the expiration of their EAOS date, and 3 left the Navy within 3 months of their calculated EAOS date. To the extent that this test quantifies the validity of the EAOS dates, then roughly 97 percent of the FY83 pilot EAOS dates are correct.

In FY83, the aviation communities had 1710 losses.[5] Only 174 of the losses occurred before the expiration of the calculated EAOS date, and 84 of these were involuntary. The remaining 90 officers, who left voluntarily before the expiration of their EAOS date, represent 5 percent of the total FY78 loss population. Of these, 28 left within the 1-year EAOS date established for FY83 losses; 14 occurred within 3 months of the calculated EAOS date. For FY78, 62 voluntary losses occurred before the EAOS date window--less than 4 percent of all FY78 losses.

In FY78, the majority of losses, 1511, occurred after the expiration of the calculated EAOS date. As was the case in FY83, most were voluntary. Nearly 70 percent of the 1511 losses that occurred after the expiration of the EAOS date were voluntary. The results from this validation are encouraging and suggest that the software is calculating the EAOS date for members of the aviation community with a reasonable degree of accuracy.

APPLICATIONS FOR THE EAOS DATE

The program that calculates the EAOS date also performs two additional computations using the date: an officer's (1) time remaining on contract (TRC), and (2) eligibility to leave the Navy. The EAOS date computation logic is applied to the beginning inventory of a fiscal year. The TRC measures the difference between a given fiscal year and an individual officer's EAOS date. For example, an officer whose calculated EAOS date was 8406 at the beginning of FY83 (8210) would have a TRC of 21 months. The software would place this officer in the "greater than 1 year but less than 2 years" category. Officers on active duty beyond their EAOS date fall into the "expired" category.

In turn, TRC is used to determine eligibility to leave the Navy. Anyone whose TRC has expired or who is in the "less than 1 year" category is considered eligible to leave at the beginning of a fiscal year; that is, anyone whose EAOS date has elapsed or will expire within the fiscal year. For example, at the beginning of FY83 (8210), an officer with an EAOS date of 8307 would be eligible to leave, while someone with an EAOS date of 8312 would be classified as ineligible. These two measures, TRC and eligibility status, allow an inventory to be analyzed in a number of different ways.

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[5]Twenty-five individuals have no calculated EAOS date due to missing or invalid data in the MSR field.

The AOCP program affords the opportunity to examine changes in the mixture of the eligible and ineligible officers when a new and widely used program is established (see Figure 4). Before FY82, the first full year of the AOCP program, little change had been observed in the percentage of the aviation community ineligible to leave the Navy. As shown, the percentage ineligible increased in FY82 and jumped again at the beginning of FY83. The variability of the pilot community is contrasted with the relative stability of the nonnuclear surface community, which has not experienced the addition of a new obligation program. An investigation of the eligibility-ineligibility mixture of specific types of pilots (e.g., jet, propeller, and helicopter) revealed some differences (see Figure 5) between FY77 and FY85. Helicopter pilots appear to be more responsive to the bonus than the other pilots.
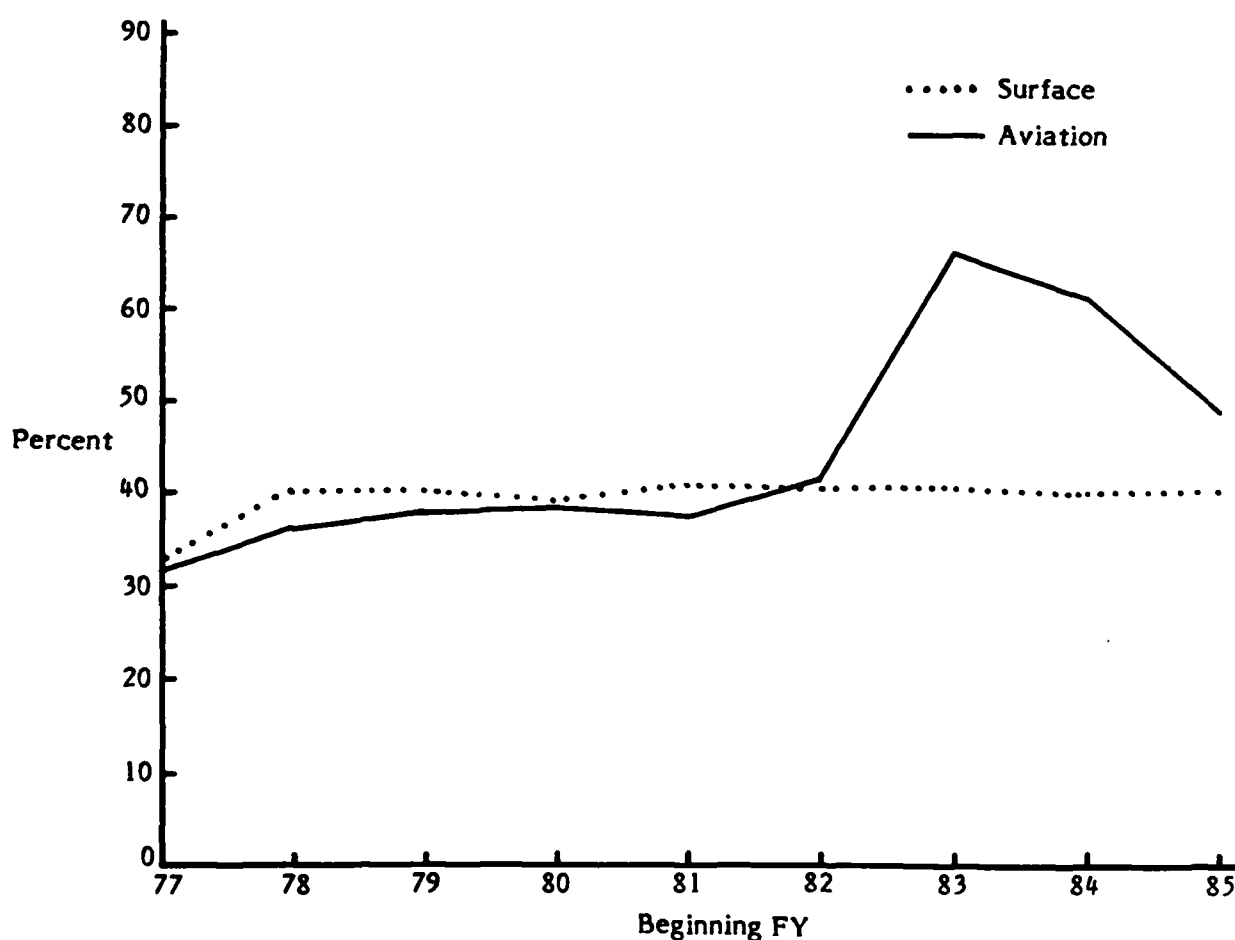

Figure 4. Percentage of total community ineligible to leave the Navy--aviation and nonnuclear surface communities (FY77-FY85).
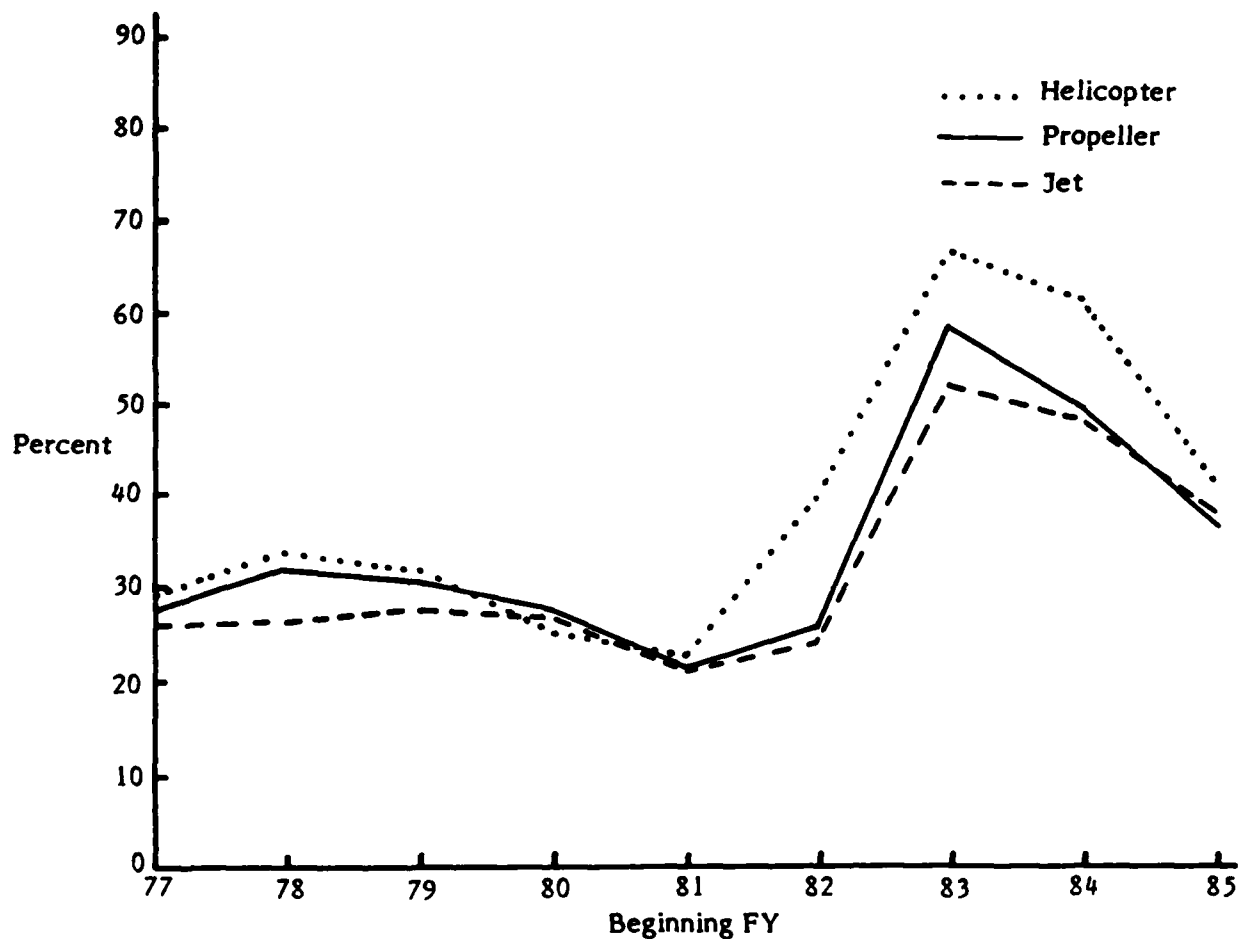
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Figure 5. Percentage of aviation community ineligible to leave by type of pilot (FY77-FY85).

Figure 6 depicts the percentage of a length of service (LOS) cell measured by year group that was ineligible to leave the pilot community at the beginning of 2 fiscal years, FY78 and FY83. As expected, the ineligible percentage is high in the early LOS cells. Most officers in these cells are still serving their initial obligation--MSR. The figure shows that in the early LOS cells (0-4) and the late career LOS cells (18-30), the percentage ineligible to leave does not differ noticeably between the 2 fiscal years. However, the 2 years differ sharply between LOS 6 and 18. Much of this variation can be attributed to the AOCP program initiated in FY81. To be eligible for AOCP, an officer must have completed the MSR, an event that typically occurs around LOS 6 or 7.
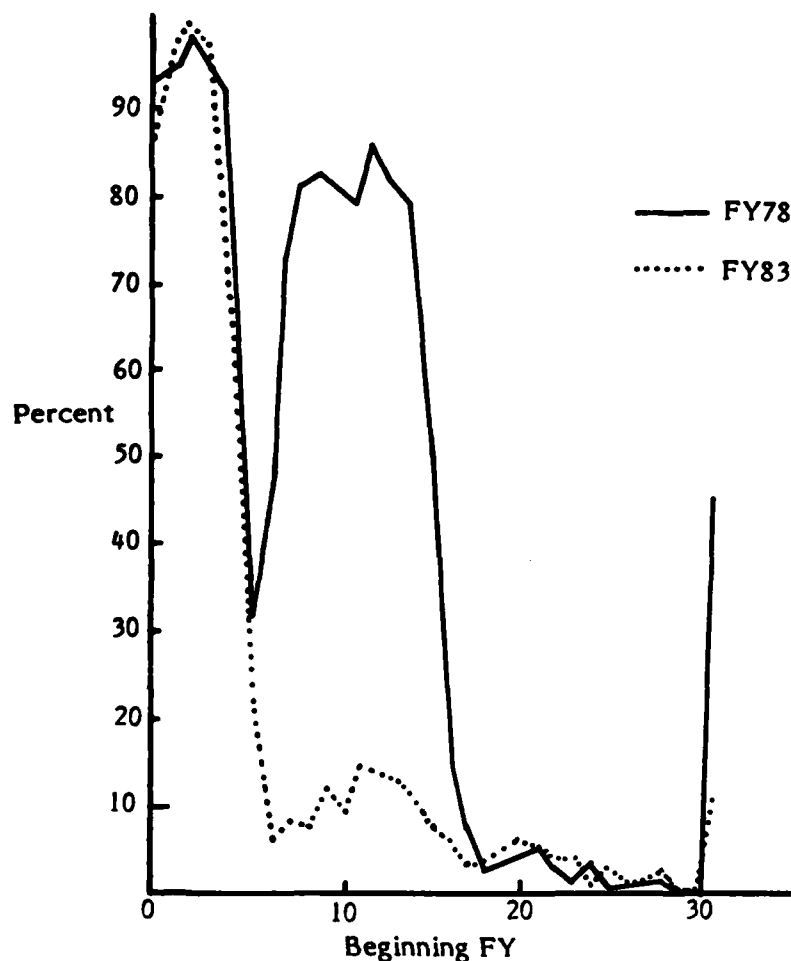
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Figure 6. Percentage of aviation community length-of-service
(LOS) cells ineligible to leave (FY78 and FY83).

Computation of the EAOS date also helps support the argument that the Navy's retention rate is an inadequate measure of a community's ability to retain officers. The rate is grounded on the assumption that officers who are going to leave the Navy will do so within 2 years of the completion of their MSRs. As shown in Table 4, however, many officers are staying in the Navy beyond this point.[6] For example, the retention rate measure would predict that all officers whose MSR expired in 1980 and who intend to leave would have done so by FY83. However, 401 officers were not yet eligible in FY83 to make a stay or leave decision. In fact, 45 percent had more than 3 but fewer than 4 years remaining under contract.

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[6]For a discussion of current and alternative retention measures and the MSR window, see Bres & Rowe (1983).

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Table 4

Relationship Between Time Remaining on Contract (TRC) and
MSR for the Pilot Community as of the Beginning of FY83

| MSR Year | Eligibles (Expired and TRC ≤ 1) | Time Remaining on Contract (TRC) (in Years) | | | | Total Ineligible |
		≤ 2	≤ 3	≤ 4	> 4	
Pre-74	2459	376	278	33	2	689
74	56	15	163	92	0	270
75	19	10	55	37	0	102
76	38	29	164	79	0	262
77	47	26	151	59	0	236
78	78	16	141	82	0	239
79	63	29	196	119	0	344
80	88	29	192	180	0	401
81	163	39	96	220	0	355
82	327	66	2	154	0	222
83	733	46	0	0	2	48
84	23	1025	0	0	1	1026
85	12	3	1634	0	0	1637

CONCLUSIONS

It is possible to calculate an EAOS date for officers; its accuracy can be indirectly measured by comparing the calculated EAOS date with the loss dates of officers who have left the Navy. The performance of the EAOS date in several validation tests suggest that the software is calculating the EAOS date with reasonable accuracy.

Work on the EAOS date algorithm is ongoing. Additions to the logic will be needed as new obligation programs are implemented, and other modifications will be needed to accommodate additional communities. Finally, software will be modified as obligation parameters, both type and length, change over time.

The EAOS date has been used to establish the TRC for individual officers, and, in turn, determine their eligibility to leave the Navy. However, the usefulness of the EAOS date should extend much farther. Research is ongoing to determine the contribution of eligibility factors to officer loss forecasting methods (Siegel, 1983).

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